Normal Structures and Common Artifacts

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A general knowledge of normal lung structure (Figs. 1.1, 1.2, 1.3, 1.4 and 1.5) and common artifacts (Figs. 1.6, 1.7, 1.8 and 1.9) is critical for interpreting lung biopsies. Histologically, there are two major types of epithelium within the lungs: respiratory (bronchial/bronchiolar) and alveolar epithelium. The respiratory epithelium lines the proximal and distal airways that start with the trachea, followed by bronchi and variable generations of terminal and respiratory bronchioles. The major histologic difference between a bronchus and a bronchiole is the presence of airway cartilage and submucosal seromucous glands in the former.

Alveolar epithelium lines portions of the respiratory bronchiole, alveolar ducts, and alveoli. Flat type I pneumocytes with highly attenuated cytoplasm and small flattened nuclei account for 95% of alveolar epithelial cells in normal lung; the remaining 5% consist of cuboidal type II pneumocytes with rounded nuclei. Type II pneumocytes become more conspicuous and profuse in injured lung and are therefore a nonspecific finding in a broad range of conditions.

The pulmonary acinus consists of a respiratory bronchiole and the distal alveolar ducts and alveoli that it serves. The pulmonary acinus is the fundamental physiologic unit of the lung but cannot be appreciated as a discrete anatomic structure in routine histologic preparations. Anatomically, each lobe of the lung is further subdivided into segments and secondary lobules that are separated by thin fibrous interlobular septa. The proximal portions of multiple pulmonary acini are clustered within the central zones of the secondary lobules, which are defined by interlobular septa (e.g., proximal acinar or centrilobular emphysema). Distal portions of the acinus are clustered next to the septa themselves (e.g., distal acinar or paraseptal emphysema). An airway (bronchus or bronchiole) courses with a small muscular pulmonary artery, and together they are referred to as a bronchovascular bundle. The veins are located within the interlobular septa and visceral pleura. The lymphatics are located within the bronchovascular bundles, interlobular septa, and pleura. Diseases such as sarcoidosis that follow lymphatic routes are often referred to as having a "lymphangitic distribution."

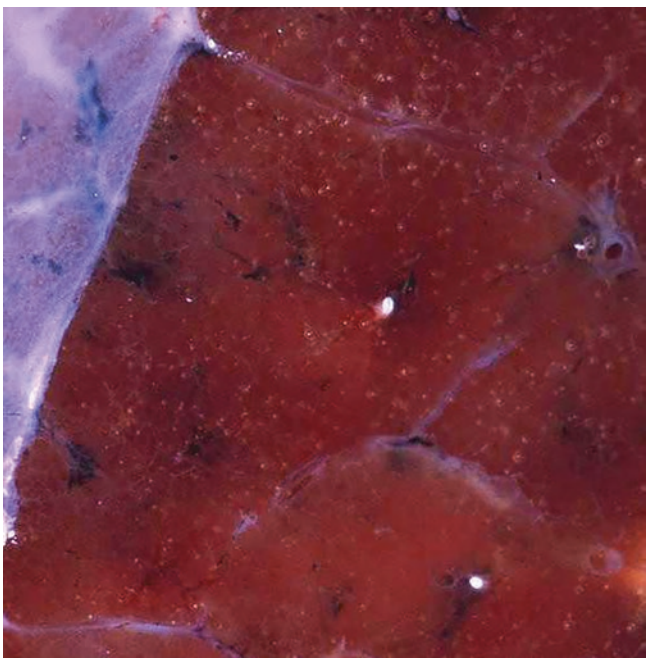

Fig. 1.1 Normal lung. Gross photograph of a peripheral portion of normal lung. On the cut surface, the tan brown spongy lung parenchyma is composed of secondary lobules in which multiple acini are aggregated. Proximal acinar structures are clustered in the center, and distal alveolar spaces are concentrated at the periphery adjacent to the thin fibrous interlobular septa that separate the lobules. The airways and blood vessels are barely visible. The outer surface of the lung is lined by the visceral pleura (upper left)

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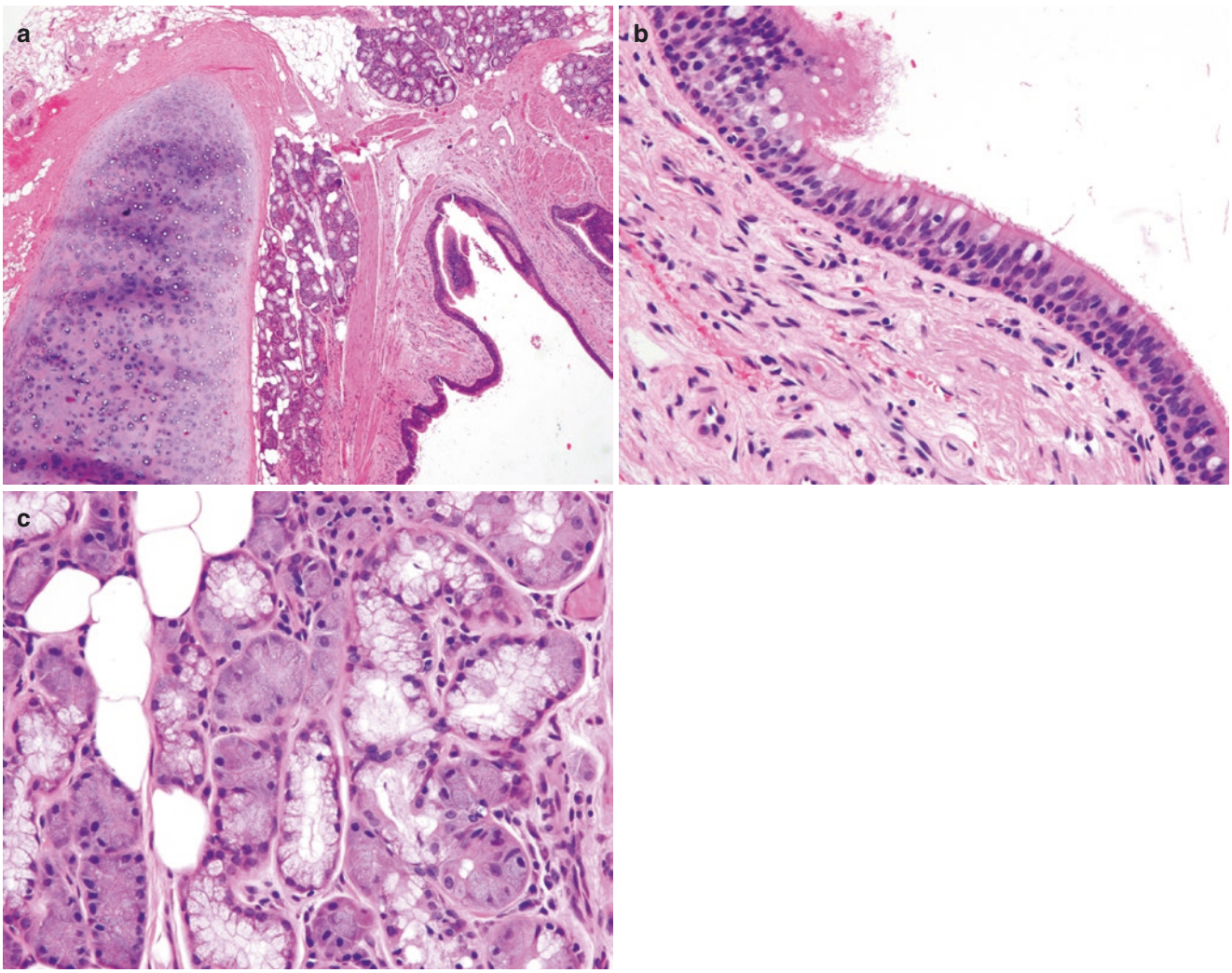

Fig. 1.2 Normal bronchus. (**a**) Low-magnification photomicrograph of a main stem bronchus showing bronchial wall cartilage and submucosal seromucous glands. (**b**) High-magnification photomicrograph showing bronchial epithelium composed of ciliated, pseudostratified, columnar epithelium with scattered mucin-secreting cells (goblet cells). (**c**) High magnification of the submucosal glands consisting of mixed serous and mucous cells

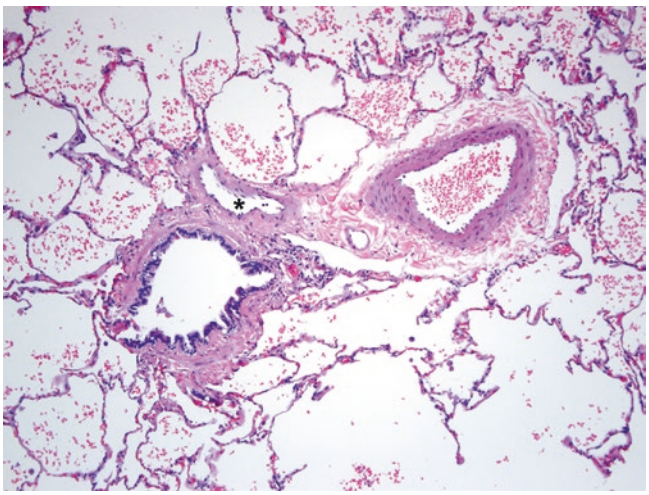

Fig. 1.3 Normal terminal bronchiole. Intermediate magnification view of a normal bronchovascular bundle. The bronchiole (left) is a small, noncartilaginous airway lined by columnar respiratory epithelial cells with a muscular wall and without intervening submucosal glands. The bronchiole is accompanied by a small muscular pulmonary artery (right) of similar caliber. Associated connective tissue and lymphatic spaces (asterisk) compose the bronchovascular bundle

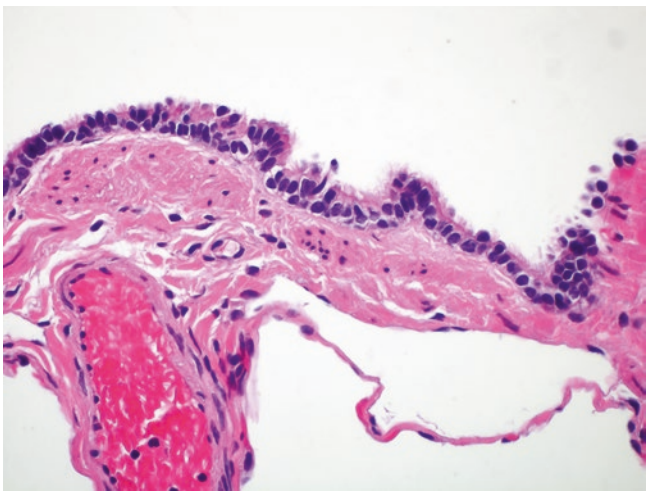

Fig. 1.5 High-magnification photomicrograph of a respiratory bronchiole. The epithelium is still predominantly ciliated but more cuboidal in shape compared with the columnar pseudostratified epithelium in the larger airway in Fig. 1.2b. Mucous cells or goblet cells become rare in respiratory bronchioles with a relative increase in nonciliated, nonmucinous Clara cells. The bronchiole wall consists of fibrous tissue and an incomplete smooth muscle layer

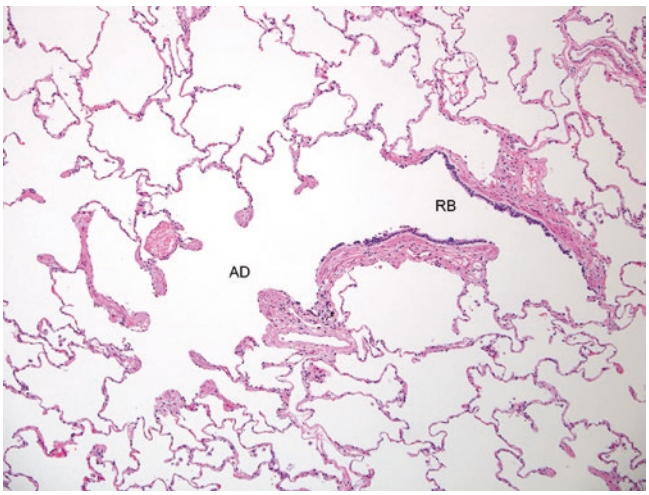

Fig. 1.4 Intermediate-magnification photomicrograph showing the respiratory bronchiole (RB) and the associated alveolar duct (AD). Note the transition from the respiratory epithelium lining the respiratory bronchiole to the flattened alveolar epithelium of the alveolar duct

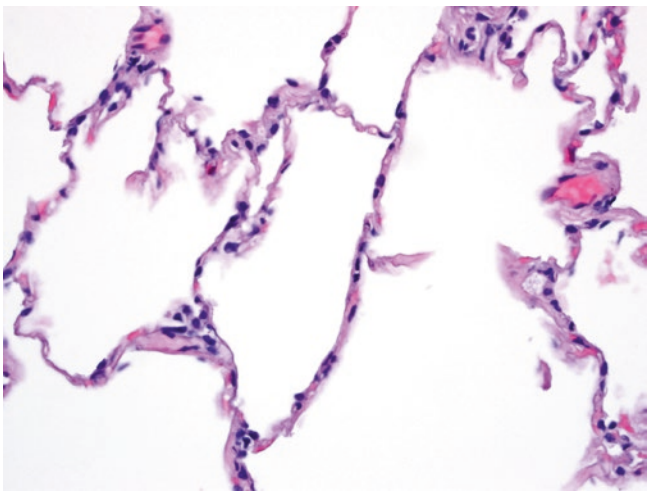

Fig. 1.6 High-magnification photomicrograph of normal alveoli. The alveolar septa are very thin and consist of flattened alveolar epithelium (pneumocytes) and delicate capillaries

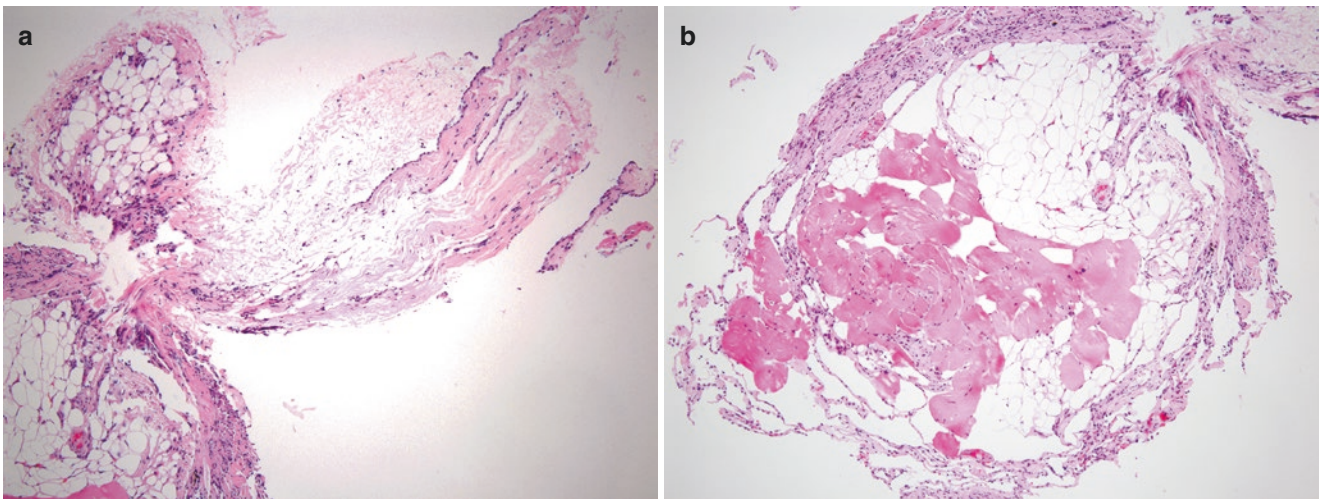

Fig. 1.7 Photomicrographs showing pleural and chest wall soft tissues in transbronchial biopsies. (**a**) Fragments of mesothelium-lined pleural tissue and mediastinum/chest wall adipose tissue are seen in a transbronchial biopsy. (**b**) Chest wall skeletal muscle and adipose tissue immediately adjacent to normal lung parenchyma in a transbronchial biopsy representing an unintended procedural artifact

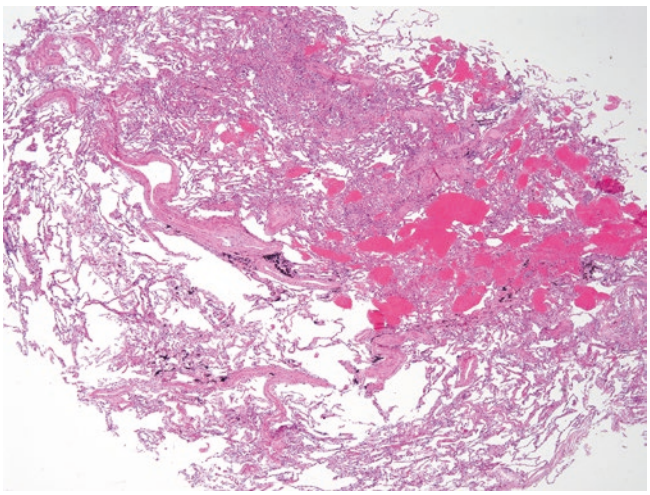

Fig. 1.8 Low-magnification photomicrograph showing artifactually collapsed lung and intra-alveolar hemorrhage. Mechanically compressed lung may mimic interstitial lung disease as a result of nonspecific thickening of collapsed interstitial structures; finding normal lung adjacent to the collapsed focus is helpful in sorting out the problem. Lack of hyperplastic alveolar pneumocytes is another helpful feature in distinguishing this artifact from interstitial lung disease. Procedure-related hemorrhage is distinguished from clinically significant intra-alveolar hemorrhage by the lack of fibrin, organizing spindle cells, hemosiderin, and associated secondary interstitial abnormalities

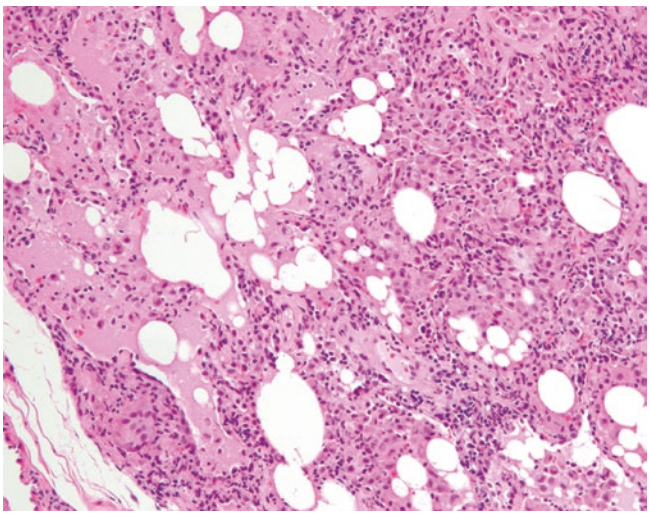

Fig. 1.9 "Pseudolipids," also termed "bubble artifact," is a processing artifact that may mimic exogenous lipid pneumonia. This artifact occurs commonly in mechanically compressed lung parenchyma, especially in areas of hemorrhage, edema, or inflammation. Lack of foreign body giant cells and other aspiration-related changes are the keys to recognizing "pseudolipids"

Suggested Reading

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